# BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

## B.Sc. Geology – Course Structure under CBCS

**(For the candidates admitted from the academic year 2010-2011 onwards)**

| Semester | Part | Course | Title | Instr. Hours /week | Credit | Exam Hours | Marks | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Int | Ext | |
| I | I | Language Course – I (LC) Tamil*/Other Languages**# | | 6 | 3 | 3 | 25 | 75 | 100 |
| | II | English Language Course – I (ELC) | | 6 | 3 | 3 | 25 | 75 | 100 |
| | III | Core Course – I (CC) | Dynamic Geology | 5 | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – II (CC) | Practical I – Structural Geology and Surveying | 5 | 4 | 3 | 40 | 60 | 100 |
| | | First Allied Course – I (AC) | | 5 | 3 | 3 | | | 100 |
| | | First Allied Course – II (AC) | | 3 | | *** | - | - | - |
| | | | | 30 | 18 | | | | 500 |
| II | I | Language Course – II (LC) Tamil*/Other Languages**# | | 6 | 3 | 3 | 25 | 75 | 100 |
| | II | English Language Course–II (ELC) | | 6 | 3 | 3 | 25 | 75 | 100 |
| | III | Core Course – III (CC) | Structural Geology | 6 | 5 | 3 | 25 | 75 | 100 |
| | | First Allied Course – II (AC) | | 2 | 3 | 3 | 25 | 75 | 100 |
| | | First Allied Course – III (AC) | | 5 | 4 | 3 | 25 | 75 | 100 |
| | IV | Environmental Studies | | 3 | 2 | 3 | 25 | 75 | 100 |
| | IV | Value Education | | 2 | 2 | 3 | 25 | 75 | 100 |
| | | | | | 22 | | | | 700 |
| III | I | Language Course – III (LC) – Tamil*/Other Languages**# | | 6 | 3 | 3 | 25 | 75 | 100 |
| | II | English Language Course–III (ELC) | | 6 | 3 | 3 | 25 | 75 | 100 |
| | III | Core Course – IV (CC) | Physical Geology | 6 | 5 | 3 | 25 | 75 | 100 |
| | | Second Allied Course – I (AC) | | **6** | 4 | 3 | 25 | 75 | 100 |
| | | Second Allied Course – II (AC) | | **4** | - | *** | - | - | - |
| | III | Non Major Elective I – for those who studied Tamil under Part I<br>a) Basic Tamil for other language students<br>Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme | Fundamentals of Geology | 2 | 2 | 3 | 25 | 75 | 100 |
| | | | | 30 | 17 | | | | 500 |
| IV | I | Language Course – IV (LC) Tamil*/Other Languages**# | | 6 | 3 | 3 | 25 | 75 | 100 |
| | II | English Language Course–IV (ELC) | | 6 | 3 | 3 | 25 | 75 | 100 |
| | III | Core Course – V (CC) | Paleontology | 4 | 4 | 3 | 25 | 75 | 100 |
| | | Core Course – VI (CC) | Practical II – Paleontology and Crystallography | 3 | 3 | 3 | 40 | 60 | 100 |
| | | Second Allied Course – II | | 2 | 2 | 3 | 25 | 75 | 100 |
| | | Second Allied Course – III | | 5 | 4 | 3 | 25 | 75 | 100 |
| | IV | Non Major Elective II – for those who studied Tamil under Part II<br>a) Basic Tamil for other language | Minerals, Rocks and Fossils | 2 | 2 | 3 | 25 | 75 | 100 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | students<br>b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme | | | | | | | |
| | | Skill Based Elective I | | 2 | **4** | 3 | 25 | 75 | 100 |
| | | | | 30 | **25** | | | | 800 |
| V | III | Core Course – VII (CC) | Crystallography and Optical mineralogy | 6 | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – VIII (CC) | Descriptive mineralogy | 5 | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – IX (CC) | Stratigraphy | 5 | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – X (CC) | Pract. III – Mineralogy & Applied Geology | 5 | 4 | 3 | 40 | 60 | 100 |
| | | Major based Elective – I (MBE) | Environmental Geology & Hydrogeology | 5 | 5 | 3 | 25 | 75 | 100 |
| | IV | Skill Based Elective – II | | 2 | **4** | 3 | 25 | 75 | 100 |
| | | Skill Based Elective – III | | 2 | **4** | 3 | 25 | 75 | 100 |
| | | | | 30 | **32** | | | | 700 |
| VI | III | Core Course – XI (CC) | Igneous Petrology | **6** | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – XII (CC) | Sedimentary and Metamorphic Petrology | **6** | 5 | 3 | 25 | 75 | 100 |
| | | Core Course – XIII (CC) | Practical IV Petrology and Economic Geology | 6 | 5 | 3 | 40 | 60 | 100 |
| | | Major based Elective II (MBE) | Economic Geology | **6** | 5 | 3 | 25 | 75 | 100 |
| | | Major based Elective III (MBE) | Remote Sensing, GIS & Mining Geology | **6** | 5 | 3 | 25 | 75 | 100 |
| | V | Extension Activities | | - | 1 | - | - | - | - |
| | | Gender Studies | | 1 | 1 | 3 | 25 | 75 | 100 |
| | | | **Total** | **30** | **26** | | | | **600** |
| | | | **Total** | **180** | **140** | | | | **3800** |

**List of Allied Courses:**

| **Group I** | **Group II (Any one)** |
|---|---|
| 1. Mathematics [3+3+4 Credit] | Physics |
| 2. Chemistry [4+2+4 Credit] | |

**செய்முறை பாடங்கள் உள்ள இயைபுப் பாடங்களுக்கு (4+2+4) தரபுள்ளிகள்**

**செய்முறை பாடங்கள் இல்லாத இயைபுப் பாடங்களுக்கு(3+3+4) தரபுள்ளிகள்**

**Note:**

| | **Internal Marks** | **External Marks** |
|---|---|---|
| 1. Theory | 25 | 75 |
| 2. Practical | 40 | 60 |

3. Separate passing minimum is prescribed for Internal and External marks

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for University Examinations shall be 40% out of 75 marks [ i.e. 30 marks]

* for those who studied Tamil upto +2 (Regular Stream)

** Syllabus for other Languages should be on par with Tamil at Degree level

\# those who studied Tamil upto $10^{th}$ or +2, but opt for other languages in degree level under Part I should study special Tamil in Part IV

*** Examination at the end of the next semester.

Extension activities shall be out side the instruction hours.

**கற்பிக்கும் கால அளவு**

மோழிப் பாடங்கள் - 1 மதிப்பீடு = 2 மணிநேரம் கற்பித்தல் வகுப்பு

கலை மற்றும் அறிவியல் பாடங்கள் :1 மதிப்பீடு = 1 மணிநேரம் கற்பித்தல் வகுப்பு
[Lecture]

= 2 மணிநேரம் பயிற்சி வகுப்பு
[Tutorial]

= 2-3 மணிநேரம் செய்முறை வகுப்பு
[Practical]

*******

## SEMESTER I

### CC I DYNAMIC GEOLOGY

**UNIT I:** Definition of Geology –– Branches of Geology – Applied Geology – Geology in the service of Man. The Solar system: – The Planets – Meteorites – Asteroids – Satellites – Comets; Evolution of the Solar system –Nebular hypothesis – Planetesimal hypothesis – Tidal hypothesis – Von Weiszacker's hypothesis and Dust Cloud hypothesis. The age of the earth – sedimentation method - salinity method – Kelvin's rate of cooling method – Radiometric methods: Uranium-lead. thorium – lead and potassium – argon methods – A note on $C^{14}$ methods.

**UNIT II:** Earthquakes: Definition – causes and effects – Focus and Epicenter – Magnitude and Intensity – Properties and propagation of seismic waves – Seismograph and Seismogram – Distribution of Earthquakes –Prediction of Earthquakes – Tsunami - Earthquakes in India. Detailed study of the structure and composition Earth's interior.

**UNIT III:** Volcanoes: Definition - Types – Phases – Solid, Liquids and Gaseous Products, Distribution – Topographic forms. Causes of volcanism – Effects of Volcanic activity - Prediction of volcanoes. Mass movements – Definition – Classification –Slow movements: Soil creep, Rock creep, and solifluction. Rapid movements: Earth flows, rock falls and landslides. Causes and remedial measures.

**UNIT IV:** Distribution of continents and oceans – Characters of continents and Oceans – Continental margin – Ocean basin – Continental drift: Wegner and Teylor hypothesis – Sea floor spreading – Concept of plate tectonics – Different kinds of plate margins – Evidences in favor and against the concepts of Continental Drift and Plate Tectonics - Mid Oceanic Ridges – Submarine trenches and Transform faults

**UNIT V:** Mountains: Classifications – Life cycle of mountains – Origin of mountains – Geosynclines - Stille's, Kay's, Strahler's and Schuchert's Classifications of Geosynclines - Characters and distribution of Geosynclines – Types of plateaus and plains. Isostasy – Prat's and Airy"s Hypotheses – Causes, effects and evidences of Sea level changes.

**TEXT BOOKS**


1. Arthur Holmes — Principles of physical Geology: Thomas Nelson & sons London.
2. Philip G. Worcester — A textbook of geomorphology: D. Van Nostrand co., London.
3. Radhakrishanan. V . — General Geology - V.V.P. Press.
4. Mahapatra, G.B. — A text book of Geology, CBS, Delhi


**REFERENCE BOOKS:**


1. William J. Miller — Principles of physical Geology : Thomas Nelson & sons , London.
2. W. D. Thornbury — A text book of geomorphology : D. Van Nostrand co., London.
3. A.L. Bloom — General Geology V.V.P. Press.
4. L.D. Leet & Judson — Physical Geology : Prentice Hall, India.


*******

**CC II P PRACTICAL – I STRUCTURAL GEOLOGY AND SURVEYING**

**Structural Geology**: contour maps and their interpretation. Exercises to predict trend of the outcrop of Horizontal, vertical an incline beds with respect to topography – reading of solid conformable maps – deciphering dip and strike of outcrops – construction of map when three points over a bedding plane are *given* construction of verti*cal sections* order of super – position – vertical thickness of formations.

Reading of solid fold and fault maps construction of vertical sections – Determination of throw of vertical faults. Reading of unconformable solid maps – construction of sections. Reading of solid maps of areas when more than one structure is involved – determination of ages of structures ad intrusions – wiring geological history – problems – problems relating to true dip and apparent dip. Determination of vertical and true thickness by calculations.

**Cartographic Appreciation of Survey of India (SOI) Topographic Sheets:** Description of features in SOI's toposheet: Extramarginal, marginal, intramarginal information, major conventional signs and symbols, physical and socio-cultural features

**SURVEYING**:-Chain survey – prismatic compass survey – plane table survey – leveling. CLINOMETER COMPASS:-To find out dip and strike of the beds.

*******

## SEMESTER II

**CC III** **STRUCTURAL GEOLOGY**

**UNIT I:** Scope and Aims of Structural Geology – Methods of representing physiographic features - Contours – Topographic and Geological maps, their preparation and uses. Physical properties of rocks – Deformation – brittleness, plastic and elastic properties. Beds and their attitudes – Dip and strike – Tends of outcrop – Rule of V of outcrops – Relation between true and apparent dips. Width of outcrops; True thickness, vertical thickness and their mutual relations.

**UNIT II:** Primary and secondary structures – primary structures of extrusive and intrusive igneous rocks – primary structures of sedimentary rocks.

Plutons – concordant and discordant plutons – dyke, sill phacolith, lopolith, batholiths, ring dykes and cone sheets – brief study of salt domes.

**UNIT III:** Folds – geometry and elements of folded surface – classification – descriptive study of different types of folds – recognition of folds in the field and on map.

Unconformities – definition – types – significance – recognition in the field and on map – over lap and off lap. Inlier and Outlier.

**UNIT IV:** Faults – definition – terminology – classification – and description – recognition in the field and on the map – effects of faults - distinction between faults and unconformities – a short account of rift valleys.

Joints – definition – geometric and genetic – classification – descriptive study – uses of joints.

**UNIT V:** Foliation – Primary and secondary foliations – Cleavage and Schistosity – Types and Origin of Rock Cleavages. Lineation – Kinds and Origin of lineation - Mechanism and Uses of Clinometer and Brunton compass. Preparation of geological reports.

**TEXT BOOKS:**

1. M.P.Billings : Structural Geology: Prentice Hall, Englewood Clifts, U.S.A,
2. C.M. Novin : Principles of structural Geology John Willey, New York.
3. De Sitter : Structural geology - McGraw Hill, New York
4. Gokhale, N.W. 1996 Theory of Structural Geology. CBS Publishers.
5. Ghosh. S.K. : Structural Geology – Fundamentals and Modern developments. – Pergamon Press.

**REFEREANCE BOOKS:**

1. V.V. Belousov - Structurral Geolgy – Moscow
2. P.C. Bedgley - Structural and Tectonic, Principles: Harper & Row, New york.
3. E.W. Spencer - An Introduction to structural Geology: Mc Graw Hill, New York.
4. Park, P.G. 1994, Fundamentals of structural Geology, John Willey & sons, Canada.

*******

## SEMESTER III

**CC IV** **PHYSICAL GEOLOGY**

**UNIT I**: Weathering of Rocks – Environment of weathering – weathering processes, chemical and mechanical weathering – Rates of weathering – kinds and products of weathering, soils – weather & climate – Role of weathering in Geologic cycle, Economic importance of weathering.

Atmosphere – Its composition and zones. Movements of atmosphere – wind – Geological actions of wind-sand dunes and their types – loses – arid cycle of erosion – characteristics of deserts.

**UNIT II**: Running water – source and surface flow – erosion, transportation and deposition – land reforms resulting from erosion and deposition – valley development – drainage patterns – fluvial cycle (youth maturity and old age) – interruptions to the normal cycle – stream rejuvenation – river capture.

**UNIT III:** Underground water – sources – water table – zone of saturation – springs and wells – artesian wells – geysers – spring deposits – aquifer – geological work of ground water – solution – Karst topography – development of karst features – characteristics of Karst regions – origin of L.St. caverns – artesian belts of Tamilnadu.

**UNIT IV**: Glaciers – origin and types of glaciers – movement of glaciers – transportation and deposition – glacio fluvial deposits – landforms produced by glaciers – short account of Ice ages.

Lakes – classification – types of lakes – lake deposits.

**UNIT V:** Seas and Oceans – waves, tides and currents– sea as a geological agent – classification of shore lines – shore line types – description of continental margin – continental – shelf – continental slope – ocean basins – submarine canyons – sea mount , guyots, mid – oceanic ridges – ocean deposits – coral reef: their types and origin ; tsunamis – distribution and origin.

**TEXT BOOKS:**


1. Philip G.Worcester : A text book of Geomorphology – D. Nostrandcomp Inc. New York.
2. Radhakrishnan.V, 1996 : General Geology, VVP, Tuticorin.
3. Mahapatra, G.b. A text book of Geology, CBS, Delhi
4. Chakranarayanan,A.B. et.al:Concepts of Geology, Scientifica Publication


**REFERENCE BOOKS**


1. D.Leet & Shelton Judson: Physical Geology – prentice Hall, Internation Inc. Englewood, Cliff, U.S.A.
2. Arthur Holms : Principles physical Geology Thomos Nelson & sons, London
3. William J, Miller : An introduction to physical Geology, D. Van Nostrand Company, Inc New York


*******

# SEMESTER IV
## CC V - PALAEONTOLOGY

**UNIT I:** Definition of Palaeontology – organic world- Animal Kingdom – classification of animals – Habitates and Habits of animals. Definition of fossils – nature and modes of preservation of fossils : Unaltered hard parts : Altered hard parts : Petrifaction , permineralisation , carbonisation, recrystallisation, silicification , mould, casts, tracks , trails, borings, uses of fossils – stratigraphic indicators – climatic indicators- indicators of palaeogeography – indicators of evolution and migration of life forms – indicators of new deposits of coal and petroleum – life through ages.

**UNIT II:** Phylum protozoa – Order,: Foraminifera: General morphology – chitinous test – septa, arrangement of chambers, suture, aperture , dimorphism – classification , geological history and stratigraphic importance. An outline of the uses and applications of Micro palaeontology.
Phyllum Porifera – A short account of sponges.
Phyllum coelentrata – class Anthozoa – zoological features – General morphology : corallum , corallite , theca , chambers, septa, fossula , columella , septal developments , classification – tabulate corals – Rugose corals evolution geological distribution – stratigraphic importance.
Sub phylum Hemichordata – class Graptozoa: order Dendroidea and Graptoloidea – general morphology , rhabdosome, stipe , theca , ccommon canal , nema , virgula , sicula , angle of divergence , central disc, uniserial , biserial , classification , geological distribution and stratigraphic importance.

**UNIT III:** Phyllum mollusca: Class Pelecypoda :- General characters – umbo , Hinge line – ligament – lunule and escutcheon – adductor impressions, pallial line , pallial sinus , dental patterns , ornamentation , classification , geological history.
Class Gasteropoda:- General morphology , shell forms , whorl , spire , spiral angle , suture , aperture , columella, umbilicus , peristome , aperture , (Holostomatus and siphonostomatus ) – types of coiling – Dextral and sinistral – ornamentation , classification and geological history.
Class Cephalopoda:- General morphology , siphuncle, septa, septal necks, connecting ringes, chambers, suture lines, (Nautilitic , Goniotitic , Ceratitic and Ammonitic) – shell forms – ornamentation – classification evolution, geological history- morphology of a Belemnite shell.

**UNIT IV:** Phyllum Brachiopoda:- General morphology , umbo, hinge line , pedicle opening , delthyrium, deltidium pseudo deltidium – Brachial skeleton – morphometric details, ornamentation , classification , geological history.
Phyllum Echonodermatea:- Class Echinoidea :- General morphology, periproct, apical system (Anus, ocular plates, Genetal plates, madriporic plates), corona (Ambulacra , inter ambulacra) – peristome – Regular and irregular echinoids – classification – geologicial history. Class crinoidea:- General morphology , calyx , dorsal cup, (Radicals , basals, intrabasals), arms , stem , classification , geological history. Class Blastoidea:- General morphology – calyx , dorsal cup (Basals, radials, deltoids, ambulacra). Brachioles , cicatrix, geological history.

**UNIT V:** Phyllum Arthropoda:- Class – Trilobita- General morphology : Cephalon: glabella, facial suture , free cheek, fixed cheek, genal angle , genal spine , cranadium; thorax – pygidium – classification – geological history.
Class Crustacea:- Sub class: Ostracoda – morphology – classification and geological history.
A brief outline of the classification of vertebrates. A short account of Devonian fishes, Mesozoic Reptiles, Siwalik mammals.
General classification of plant kingdom – plant fossils from India – A brief account of the following plant fossils :- Glossopteris , Gangamopteris , Ptilophyllum , Calamites , Lepididendron and Sigillaria.

**TEXT BOOKS:**


1. Henry woods : Inveretebrate palaeontolgy – Cambridge.
2. Romer , A.S. : Vertebrate palaeontology, Chicago press.
3. Arnold, C.A., : An introduction to Palaeobotany., MC-Graw Hill.
4. B.U. Hag and A. Boersma (1978) Introduction to marine Micropalaeontology. Elsevier, Netherlands


**REFERENCE BOOKS**


5. Raup, D.M. and Stanely, M.S. : Principles of Palaeontology, CBS Publishers.
6. Moore , R.C., Laliker , C.G.& Fishcher, A.G. : Invertebrate Fossils , Harper brothers
7. Shrock. R.R. and Twenhofel , W.H – 1953 : Principles of invertebrate Palaeontology, Amold publication


*******

**CC VI P PRACTICAL- II PALAEONTOLOGY AND CRYSTALLOGRAPHY**

**PALAEONTOLOGY**

Megascopic identification and description of the following fossisls:-

Corals: Calceola, zapherenits, Lithostraotion, Favosites, Halysites,;

Brachiopoda: Spriifer, Productus, Terebratula, Rhynconella, Atrypa, Athyris, Orthis,

Pentrimites, Cideris, Hemicidaris, Micraster, Holaster, Hemisaster, Stygmatophygus,

Arca, Cardium Meretrix, Cardita, Pectan, Trigonia, Megaladon, Pholodomya, Spondylus, Gryphea, Exogyra, Orstrea, Inoceramus, Alectreyonia, Hippurities,

Natica, Turbo, Trochus, Turritella, Cerethium, Conus, Voluta, Murex, Fusus, Physa, Bellarophon,

Nautilus, Goniatites, Ceratites, Acanthoceras, Scholenbachia, Perispinctus, Desmoceras, Hamites, Scaphites, Baculites, Turrilites and Belemnites,

Paraoxides, Calamyne, Phacops. Trinucleus,

Phyllograptus, Tetragraptus, Didymographtus, Diplograptus, Monograptus,

Glossopteris, Gangamopteris, Ptillophyllum, Lepidodentron, Sigillaria and Calamites.

**MICRO FOSSILS:-**

Lagena, Nodosaria, Textularia, Operculina, Elphidium, Ammonia,

**DIAGRAMS:-**

Paraoxides, Pentremites, Trigonia, Meretrix, Murex, Turritella, Nautilus, Spirifer, Arca.

**CRYSTAL MODELS**

Identification and description of the following crystal models:-

Galena, Garnet, Florite, Pyrite, Tetrahedrite, Boracite, Sphalerite, Cuprite, Zircon, Casseterite, Rutile, Octahedrite, Apophyllite, vesuvianite, Scheelite, Meonite, Wulfenite, Chalcopyrite, Beryl, Zincite, Apatite, calcite, Haematite, Dolomite, Corundum, Tourmaline, Phenacite, Dioptase, Quartz, Olivine, topaz, Barite, Andalusite, Cordierite, Sulphur, Staurolite, Hypersthene, Calamene, Struvite, Epsemite, Gypsum, Orthoclase, Pyroxene, Augite, Amphibole, Hornblende, Epidote, Sphene, Axinite, Albite, Kyanite, and Rhodenite.

**SIMPLE TWIN MODELS:-**

Galena, Florite, Pyrite, Rutile, Calcite, Quartz, Staurolite, Gypsum, Augite, Orthoclase, Albite.

*******

## SEMESTER V
## CC VII - CRYSTALLOGRAPHY & OPTICAL MINERALOGY

**UNIT I:** Definition of crystal – morphological characters of crystal – faces –forms – edges solid angles – Interfacial angle. Contact Goniameter and its use. Symmetry elements – crystallographic axes – crystal notation – parameter system of Weiss and Miller indices – axial ratio – laws of crystallography – the law of constancy of symmetry , the law of constancy of interfacial angles and the law of rational indices. Classification of crystals into systems and classes - Holohedral , Hemihedral, Hemimorphic and Enantiomorphic forms in crystals. Elementary knowledge of spherical and sterographic projections. study of the symmetry elements, and forms of the Normal, pyritohedral , tetrahedral and plagiohedral classes of cubic system with special reference to well developed crystals of Galena Spinel , Garnet, Flourite , Diamond , Pyrite , Tetrahedrite , Boracite and cuprite.

**UNIT II:** Study of symmetry elements and forms of Normal, Hemimorphic, Tripyramidal, Pyramidal Hemimorphic, Sphenoidal and Trapezphedral classes of Tetragonal system with special reference to well developed crystals of zircon, Rutile, Cassiterite, Vesuvianite, Apophyllite, Shellite, Melonite, Wulfenite and Chalcopyrite.

Study of the symmetry elements and forms of Normal, Hemimorphic Tripyramidal, pyramidal Hemimorphic, Trapezohedral, Rhombohedral , Rhombohedral Hemimorphic , Trirhombohedral and Trapezohedral classes of Hexagonal system with special reference to well defeloped crystals of Beryl , Zincite, Apatite , Calcite , Corundum , Tourmaline, Phenacite and Quartz.

Study of the symmetry elements and forms of the Normal , Hemimorphic and Sphenoidal classes of Orthorhombic system with special reference to well developed crystals of Barite , olivine topaz, staurolite, Sulphur, Calamine, Struvite and Epsomite.

**UNIT III:** Study of the symmetry elements and forms of the Normal classes of the Monoclinic and triclinic systems with special reference to well developed crystals of Gypsum, Orthoclase, Albite, Augite, Axinite and Kyanite. Twin crystals – Definitions – Effects of Twinning – laws of twinning – composition plane, twinning plane and twinning axis, indices of twins – simple and repeated (polysynthetic twins), contact and penetration twins: secondary twins. Study of twin laws pertaining to the following crystals – Floruite (spinal law), Pyrite (iron crosss twin). Rutile (geniculate), Calcite, Quartz (Brazil laws), Aragonite (mimetic twin), Staurolite (cruciform), Gypsum, Augite and Feldspars (Carlsbad, Baveno , Manebach, Albite and Pericline).

**UNIT IV:** Nature of light – Ordinary and polarized light – Refraction and reflection. Refractive index, Critical angle and Total internal reflection. Double refraction - Plane polarization by Reflection, Brewster's law - Plane polarization by Refraction, Nicol Prism - Plane polarization by absorption, Polaroid. Petrological microscope and its parts – Optical accessories, their construction and uses – Quartz wedge (Determination of order of Interference Colour), – Gypsum plate and Mica plate (Determination of Fast and Slow vibration directions), and Bereck Compensator (Determination of Birefringence)

**UNIT V:** Optical classification of minerals. Optical properties of isotropic and anisotropic minerals observed under parallel and crossed Nicols. Differences between Isotropic and anisotropic minerals. Definition of extinction, Types of extinction, Extinction angles and their determination, and uses – Characters of Uniaxial and biaxial minerals – Optics axis and optic axial angle – Acute and Obtuse Bisectrix – Optic sign of Uniaxial and Biaxial minerals – Uniaxial and Biaxial Indicatrix - Sign of elongation - Optical anomalies.

**TEXT BOOKS:-**


1. Dana, F.S.(1955) : A text book of mineralogy - Asia Publishing House - Willey.
2. Wade., F.A. & Mattox, R.B. (1960) : Elements of crystallography and mineralogy, Harper & Bros.
3. Phillips, P.C (1956) : An introduction to crystallography Longmans green & co.,
4. Kerr.P.F : Optical Mineralogy.


**REFERENCE BOOKS:-**


1. Phillips, W.R. Optical Minerlogy,Griffen, D.T.1986.
2. Walhstrom, E.F.1960 Optical crystallography – John wiley.
3. Winchel, A.n. 1968 Elements of optical mineralogy, part 1 & 2 wiley Eastern.
4. Smith H.G. Minerals under microscopy – Murby.

## CC VIII - DESCRIPTIVE MINERALOGY

**Unit I:** Definition of Mineral and Mineraloid – Scope and aim of Mineralogy. Chemical elements and periodic Table - Bonding of atoms – Metallic, Co- valent, Ionic and Van der Walls Bonding in Minerals, Structure and classification of silicates. Isomorphism, Polymorphism and Pseudomorphism in minerals. Physical properties of minerals depending upon cohesion and elasticity, specific gravity, light, heat, electricity, magnetism and the senses. Determination of specific gravity of minerals- Joly balance and Beam balance methods – simple blow pipe tests.

**UNIT II:** Mineralogy, Structure, Chemistry, Optical and Physical properties, Modes of occurrences and industrial uses of the following groups of minerals: Polymorph and varieties of Quartz –Alkali and Plagioclase group of Feldspars – Nepheline and Sodalite group of Feldspathoides - and Zeolites.

**UNIT III:** Mineralogy, Structure, Chemistry, Optical and Physical properties, Modes of occurrences and industrial uses of the following groups of minerals: Pyroxenes, Amphiboles, Micas, Olivine and Garnet.

**UNIT IV:** Physical and optical properties, chemical composition, uses and modes of occurrence of the following minerals. Epidote, Chlorite, Scapolite, Cordierite, Talc, Serpentine, Steatite, Calcite, Dolomite, Andalusite, Kyanite, Sillimanite, Topaz, Staurolite, Beryl, Tourmaline, Fluorite, Apatite, Zircon, Rutile, Sphene and Corundum.

**UNIT V:** Mineralogy, mode of occurrence, uses and distribution in India of the minerals required for the following industries. Abrasives, Fertilizer, Paint, Refractory, Glass, Ceramic and Cement. Mineral wealth of Tamil Nadu.

**REFERENCE BOOKS:**


1. Dana, F.S. 1955 – A text book of mineralogy – Asia publishing House, Wiley.
2. Read, H.H- 1974, - Rutley's elements of mineralogy – Thomas murby & co.
3. Mason ., B and Berry, L.G - Elements of Mineralogy – W.H. Freeman & Co.


**REFERENCE BOOKS:**


1. Deer. W.A.,Howoe. R.A and Zuessman, J. -1966 .An introduction of the Rock forming minerals . Longmans.
2. Berry , Mason, Dietrich,2000 - Mineralogy, CBS Publication
3. Cornelis Klen and Cornelius S. Hurlbut , 1985 – Manual of Minerology, John wiley & Sons


*******

**CC IX** **STRATIGRAPHY**

**UNIT I:** **Principles of stratigraphy**: law of order of superposition. law of uniformitarianism and law of faunal succession. Correlation: fossiliferous and unfossiliferous rocks. Standard stratigraphic scale and Indian Geologic Time scale. Imperfections in Geological record. Geological divisions. Stratigraphic classification and Nomenclature. Stratigraphic Units: Lithostratigraphic unit, Biostratigraphic unit , Geochronologic Unit. Homotaxis. Physiographic divisions of India: Peninsular India, Indogangetic alluvial plains, Extra Peninsular India

**UNIT II:** **Precambrian Stratigraphy**: Archaeans of Dharwar Province, Archaeans of Eastern Ghat - The Sausar and Sakoli Group, Archaeans of Singhbhum – Iron Ore Group and Gangpur Group. Archaeans of Tamilnadu, Mineral Wealth of Archaeans of India, The Eparchaean Unconformity, Stratigraphy and Mineral Wealth of Cuddapahs, Stratigraphy and Mineral Wealth of Vindhyans, Kurnool group, Life during Precambrian

**UNIT III:** **Paleozoic Stratigraphy:** Distribution of Paleozoic rocks in India, Cambrian of Salt Range, Age of Saline Series, Upper Carboniferous and Permian rocks of Salt Range, Paleozoic rocks of Kashmir Valley, Paleozoic rocks of Spiti Valley, Paleozoic rocks of Peninsular India,

**UNIT IV:** **Mesozoic Stratigraphy**: The Depositional Environment-distribution-life-classification and economic importance of Gondwana formations of India, Coastal Gondwana of India, Gondwana formations of Tamilnadu, Triassic of Spiti – The Lilang System, Jurassic of Kutch, Cretaceous of Tiruchirapalli – Pondicherry – Bagh Beds, Deccan traps : distribution , structure , Lameta beds – infratrapean and intertrappean beds, age of the Deccan traps.

**UNIT V:** **Cenozoic Stratigraphy:** Comprehensive account of the geological events took place during Cenozoic era in India, rise of Himalayas, stratigraphy of Siwalik Super Group, fauna and flora of Siwaliks, Tertiary rocks of Assam, Karewa formation, Tertiary rocks of Tamilnadu, Tertiary rocks of Kerala, Pleistocene Glaciation - Mineral wealth of Tertiary rocks of India:

**TEXTBOOKS:**


1. Krishnan M.S. (2003) - Geology of India and Burma, 6th Edition, CBS.
2. Wadia D.N. (1953) – Geology of India, TATA McGraw – Hill.
3. Ravindrakumar K.R. - Stratigraphy of India.
4. Lemon R.Y (1990) - Principles of Stratigraphy, Merrill Publishing Co.


**REFERENCE BOOKS:-**


1. Pascoe, E.H.(1968) - A manual of the Geology India and Burma, Govt of India Publications.
2. Gregory , J.W. and Barret B.H - General stratigsraphy mathuen.


*******

**CC X P PRACTICAL – II MINERALOGY AND APPLIED GEOLOGY**

**MEGASCOPIC MINERALOGY:**

Megascopic identification and description of the following: Quartz, Rosy quartz, Amethyst, Chalcedony, Agate, Flint, Jasper, Chert, Opal, Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Nepheline, Leucite, Sodalite, Enstatite, Bronzite, Hypersthene, Diopside, Augite, Spodumene, Acmite, Rhodonite, Wolastonite, Anthopillite, Tremolite, Actinolite, Hornblende, Glaucophane, Olivine, Serpentine, Muscovite, Biotite, Vermiculite, Chlorite, Epidote, Garnet, Olivine, Natrolite, Stilbite, Apophyllite, Talc, Steatite, Andalusite, Kyanite, Sillimanite, Staurolite, Cordierite, Apatite, Beryl, Topaz, Calcite, Dolomite, Tourmaline, Zircon, Fluorite.

**MICROSCOPIC MINERALOGY:-**

Microscopic identification and Description of the following:-

Quartz, Orthoclase, Microcline, Albite, Oligoclase, Labradorite, Nepheline, Leucite, Enstatite, Hypersthene, Glaucophane, Biotite, Muscovite, Olivine, Epidote, Garnet, Apatite, Zircon, Sphene, Tourmaline, Calcite, Andalusite, Kyanite, Sillimanite, Staurolite, and Cordierite

**APPLIED GEOLOGY:-**

Interpretation of maps – Calculation of ore reserves – Included area method.

Simple problems relating to interpretation of hydrogeological data.

**BLOW PIPE:-**

Identification of the following mineral powders by simple blow pipe tests:-

Apatite, Barite, Calcite, Celestite, Cerusite, chalcopyrite, Galena, Gypsum, Chromite, Haematite, Magnesite, Magnetite, Psilomelane, Pyrolusite, Siderite, Sphalerite, Strontianite, Witherite, Stibnite, Ilmenite and Worlframite.

*******

**MBE I** **ENVIRONMENTAL GEOLOGY AND HYDROGEOLOGY**

**UNIT I:** **Environmental geology**: Definition of ecology and environmental Geology. Different ecosystems. Classification of Natural resources. A short account of renewable and nonrenewable resources. Environmental problems due to surface geological processes. Causes, hazards and remedial measures relating to landslides, floods, and soil erosion, Impact of wind on environment. Degradation of coastal environment and measures for coastal protection.

**UNIT II:** Influence of deep seated geological processes – Earthquake hazards, Earthquake prediction control and warning; Reservoir – induces seismicity – hazards of volcanism; Techniques of volcanic prediction and human adjustments to volcanic environments. Benefits of volcanism. Man as an agent of environmental modifications. Environmental degradation due to mining and mineral processing. – Effects of urbanization on surface water, causes for ground water pollution. Population explosion and their pressure on geological environments.

**UNIT III :** **Hydrogeology :**Ground water in Hydrologic cycle – origin of ground water meteoric water, connate water and Juvenile water – vertical distribution of ground water – zone of aeration, zone of saturation and water table. Springs – geological conditions favouring development of springs.
Definition of aquifers, aquitards and aquicludes. Geologic formations as Aquifers. Types of Aquifers – unconfined, confined, and perched Aquifers – Artesian wells, peizometric surface.

**UNIT IV:** Rock properties affecting Ground Water, openings in rocks. types of openings – primary openings – secondary openings. Porosity, specific yield, specific retention and permeability. Ground water movement - forces causing ground water movement: seepage, capillary movement, laminar flow, turbulent flow, Darcy's law co-efficient of permeability and field measurement of permeability.
Fluctuations in Ground water levels – causes of fluctuations.

**UNIT V:** Ground water quality – physical, Bacterial, and chemical qualities – drinking water standards – major ions affecting chemical quality of ground water. Ground water recharge – natural and artificial recharge.
Ground water exploration – surface methods – electrical resistivity method.
Water wells – types of wells – well construction and development – collector wells and infiltration galleries.
Ground water in Tamilnadu.

**TEXT BOOKS:**


1. Tolman., G.F. 1937 Ground water McGraw Hill. New York.
2. Todd, D.K. 1959 Ground water Hydrology. John wiley & Sons.
3. Davis, S.N. & Deweist. 1966 Hydrogeology , John Wiley & Sons.
4. Regunath, H.M. 1983 Ground water, Wiley Eastern.
5. Valdiya, K.S (1987). Environmental Geology – Indian Context. Tata McGraw-Hill., New Delhi
6. Kellar, E.A. 1979 Environmental Geology, Charless. Merrill publishing Co. ohio.
7. Lundgren, I. 1986 Environmental Geology , Prentice Hall.


**REFERENCE BOOKS**


1. Walton, W.C. 1970 Ground water Resources evaluation, McGraw Hill.
2. Karanath, K.R. 1987 Ground water Assessment Development & management Tata McGraw Hill.
3. Howard, A.D. & Ramson. I.1978, Geology in environmental planning. McGraw Hill, New Delhi


*******

## SEMESTER VI

**CC XI** **IGNEOUS PETROLOGY:**

**UNIT I:** Definition of Petrology – Earth zones. Composition and constitution of magmas – Primary and Parental Magmas. Forms of Intrusive igneous rocks: Concordant forms - Sill, Laccolith, Lopolith and Phacolith, Discordant forms - Dykes, Cone Sheets, Volcanic neck, Ring dyke, Batholiths, Stocks, Bosses and Psymaliths. Forms of Extrusive igneous rocks: Lava flows, Pyroclastic deposits - Agglomerate, Lapilli, volcanic ash and volcanic froth

**UNIT II:** Structures vesicular and Amygdaloidal structures – block lava – Ropy lava – pillow structure – flow structure – sheet joints- mural jointing – columnar jointing – rift and grain. Textures: Definition and description - crystallinity: crystallites and microlites – Devitrification – Granularity – shapes of crystals , mutual relations – Equigranular textures: allotriomorphic hypidimorphic, Panidiomorphic. inequigranular Textures: porphyritic and Intergrowth texture – Trachytic texture – Intergrowth texture strctures orbicular structure Spherulitic structure – Perlitic fracture. , Directive textures, Overgrowth textures, Reaction textures - Micro Structures

**UNIT III:** Classification: bases of classification – megascopic classification – classification based on colour index – based on the proportion of Alkali to plagioclase feldspars. Based on silica saturation – based on alumina saturation – A short account of CIPW classification , Normative minerals, salic and femic groups – mention of the main divisions, classes, orders, suborders, rangs and subrangs only. Merits and defects of CIPW classification – Tyrrels tabular classification.

**UNIT IV:** Texture, Mineralogy, Classification, and Modes of occurrence of: Granite, Granodiorite, Syenite, Diorite, Gabbro, their hypabyssal and volcanic equivalents. Petrographic characters, distribution in India and origin of Pegmatites, Lamprophyres, Alkaline rocks, Dunite, Peridotite and Anorthosites.

**UNIT V:** Crystallization of Unicomponent magma – Crystallization and petrogenetic significance of Binary magmas: Diopside – Anorthite Eutectic system, Albite – Anorthite Solid-Solution system, Forestrite – Silica incongruent melting system and Ternary system (Ab – An – Di). Reaction principle and Bowen's reaction series - Causes for the diversity of Igneous rocks – Magmatic Differentiation: Fractional Crystallization, Liquid immiscibility, Assimilation - Short notes on: Consanguinity, Variation diagrams and petrographic provinces.

**TEXT BOOKS:-**


1. Tyrrel, G.W. 1978 The principles of petrology – Chapman and Hall Ltd., London.
2. Bowen, N.L. The Evolution of the Igneous Rocks – Dover publication, Inc, New York.
3. Barth, FW. 1962 Theoritical petrology - Wiley.
4. Walstrom, E.E. 1961 Theoritical Igneous petrology, Wiley.
5. Turner.F.J and Verhoogen.J –1960.- Igneous and Metamorphic petrology – McGraw Hill.
6. Hatch, F.H. Wells, A.K. Petrology of Igneous Rocks, Thomas Murby & Wells, M.K. – 1949
7. Johannesen, A – 1962 Descriptive petrography of Igneous Rocks, Vols. I to IV - Allied Pacific.


*******

**CC XII** **SEDIMENTARY & METAMORPHIC PETROLOGY**

**UNIT I:** Sedimentary process – disintegration & decomposition of rocks – transportation – deposition – diagenesis. A broad classification of sedimentary rocks into residual mechanical, chemical and organic Groups. Structures of sedimentary rocks. mechanical, chemical and organic structures. Textures of sedimentary rocks – clastic and non – clastic textures.

**UNIT II:** Residual deposits – terra rossa , clay, laterite and bauxite and soils. Mechanical deposits – rudaceous, arenaceous and argillaceous groups. Heavy minerals in sand and sandstones. A descriptive study of Conglomerate, Breccia, Sandstones and Shales.

**UNIT III:** Chemical deposits – siliceous , carbonaceous, ferruginous and salt deposits. organic deposits – calcareous, siliceous, phosphatic, ferruginous and carbonaceous deposts. A breief study of Flinit, Chert, Siderite, Gypsum, Rock Salt, Caliche. Guano and Kiesellgher. Descriptive study of different types of calcareous and carbonaceous deposits.

**UNIT IV:** Definition of metamorphism –Agents and kinds of metamorphism – facies, zones and grades of metamorphism – metamorphic structures and textures. cataclastic metamorphism and its products. Retrograde metamorphism.

Thermal metamorphism of pelitic sediments, pure and impure calcareous rocks. A brief study of Breccia, Flaser, Mylonite, Hornfels, Marble, Ophicalcite.

**UNIT V:** Dynamorthermal metamorphism of pelitic sediments. plutonic metamorphism petrography and origin of charnockites – metamorphic differentiation – pnumatolitic and injection metamorphism – anataxis and palingenesis. Brief study of Slate, Phyllite, Quartzite, Schist. Gneiss, Granulite, Leptynite, Charnockite, Ecologite, Amphibolite, Schorl, Adinole, Lit- Par- Lite – gneiss and Migmatite.

**TEXT BOOKS:**


1. Tyrrel, G.W - Principles of petrology, Asia Publishing House.
2. Huang, W.T. -Petrology, MC Graw Hill
3. Pettijhon, F.J. -Sedimentary Rocks, Harper & Bros.
4. Harker, A. -Petrology for Students, Cambridge,


**REFERENCE BOOKS**


1. Turner,F,J &Verhogen,J -Igneous and Metamorphic Petrology, MC Graw Hill.
2. Williams, H, Turner, F.j. & Gillibert, C.M. - Petrography, Freeman.
3. Winkler, A. G.F. - Petrogenesis of Metamorphic Rocks, Mc Graw Hill.


*******

**CC XIII P PRACTICAL – IV PETROLOGY & ECONOMIC GEOLOGY**

**PETROLOGY:**

**Megascopic identification of the following rocks:**

Granite, Graphic granite, Pegmatite, Aplite, Schorl Rock, Granite Porphyry, Syenite, Syenite porphyry, Diorite, Gabbro, Anorthosite, Dunite, Pyroxenite, Dolerite, Diabase Porphyry, Basalt, Trachyte, Rhyolite, Obsidian, Pumice, Scoria. Conglomerate, Breccia, Sandstone, Arkose, Shale, Limestone, Laterite, Peat, Lignite, Slate, Phyllite, Schists, Gneisses, Quartzite, Marble, Amphibolite, Ecologite, Leptynite, Charnockite, Khondalite, Calc - Granulite and Basic Granulite.

**Microscopic identification and description of the following rocks:-**

Mica Granite, Hornblende Granite, Tourmaline Granite, Schorl Rock, Aplite, Graphic Granite, Mica Syenite, Hornblende Syenite, Nepheline Syenite, Diorite, Gabbro, Norite, Dunite, Peridotite, Granite – porphyry. Syenite – porphyry, Diorite – porphyry, dolerite, minette, Vogasite, Anorthosite, Trachyte, Andesite, basalt, phonolite, volcanic Breccia, vitrophyre, conglomerate, Breccia, sandstone, Arkose, shale limestone, slate, chlorite schist, mica schist, Kyanite schist, Staurolite schist, garnetiferous schist, Glaucophane schist, Granulite, Charnockite, Ecologite Amphibolite, Leptynite, khondalite, Cordierite, gneiss, garnet – Sillimanite gneiss Calc Granulite.

**ECONOMIC GEOLOGY:-**

**Megascopic identification and description, Indian occurrences and uses of the following ore and industrial Minerals: -**

Realgar, Orpiment, Stibnite, Molybdenite, Galena, Sphalerite, Cinnabar, Covelite, Bornite, Chalcophyrite, Pyrite, Arsenopyrite, Marcasite, Barite, Celestite, Gypsum, Cuprite, Zincite, Corundum, Hematite, Ilmenite, Magnetite, Chromite, Franklinite, Cassiterite, Rutile, Pyrolusite, Psilomelane, Goethite, Limonite, Bauxite, Calcite, Dolomite, Magnesite, Siderite, Aragonite, Witherite, Strontionite, Cerussite, Azurite, Malachite, Chrysocolla, Columbite, Halite, Fluorite, Phosphatic Nodule, Monazite, Graphite, Coal and its varieties.

*******

**MBE II** **ECONOMIC GEOLOGY**

**UNIT I** : Historical development of ecnonmic Geology. Materials of mineral deposits – ore minerals, gangue minerals, tenor and grade or ores. classification of mineral deposits. Outline of Lindgren's and Bateman's classification. Controls of ore localization – structural controls, stratigraphic physical and chemical – brief study of metallogenetic epochs and provinces – geologic thermometers.

**UNIT II:** Magmatic processes. – mode of formation – Early magmatic processes and deposits, disseminations. segregations and injections – Late magmatic processes and deposits – Residual liquid segregation and injection – immiscible liquid segregation and injection – sublimation. Contact Metasomatic processes – the process and effects – resulting mineral deposits. Hydrothermal processes – principles – Factors affecting deposition – wall rock alteration – minerals sequence – cavity filling deposits Fissure veins, shear – zone, stock-work, saddle reef, ladder vein, fold cracks, breccia filling, solution cavities, pore space and vesicular filling – replacement deposits, the process and deposits – criteria of replacement.

**UNIT III:** Sedimentary processes and cycles – principles involved in sedimentation – cycles of Iron and manganese, weathering processes – principles- Residual concentration process and deposits – mechanical concentration principles – evluvial, alluvial, beach and eolian placers – paystreak and bonanza. Oxidation and supergene sulphide enrichment – solution and deposition in the zone of oxidation – secondary sulphide enrichments – Gossans and capping.
Metamorphic processes – Formation of Graphite, Asbestos, Talc, Soapstone and Sillimanite group of minerals.

**UNIT IV:** Diagnostic physical properties, chemical composition, uses, modes of occurrence and distribution in India of the following economic minerals. Graphite, Realgar, Orpiment, Stibinite, Molybdenite, Cinnabar, Anglesite, Barite, Gypsum, Celestite, Corundum, Ochre, Ilmenite, Chromite, Franklinite, Cassiterrite, Magnesite, Cerussite, Halite, Fluorite, Phosphatic Nodule, Monazite, Wollastonite, Colembite, Tantalite, Samarskite, Asbestos, Steatite and Vermiculite. Mineralogy, mode of occurrence, uses and distribution in India of the following precious metals and minerals. Gold deposits – Gem stones.
Character, distribution and mode of occurrence of structural and building materials.

**UNIT V :** Mineralogy, mode of occurrences, uses and distribution in India of the following metalliferous deposits – Iron, Manganese, aluminium, copper, lead, Zinc – chromium.
Fossils fuels – coal – uses, classification, constitution, origin and distribution in India. Petroleum-composition, uses, theories of origin, oil traps, and important oil fields of India.

**TEXT BOOKS:-**


1. Bateman Allan .M. -Economic Mineral Deposits, Asian Publishing House, 2nd Edition 1962.
2. Lindgren W. -Mineral Deposits, MCGraw Hill, 1933.


**REFERENCE BOOKS:-**


1. Coggin, B. and Dey, A.K. - India's Mineral Wealth, oup 1955.
2. Park, C.F. and Macdiarmid, R.A- Ore deposits, Freeman, 1970
3. Krishnaswamy ,s. - India's Mineral Resources, oxford and IBH.
4. Deb.S. - Industrial Minerals and Rocis of India, Allied, 1980.
5. Gokhale, K.V.G.K. and Rao , T.C- Ore deposits of India, their distribution and processing, Thosmson press, 1978.


*******

**MBE III** **REMOTE SENSING, GIS & MINING GEOLOGY**

**UNIT I:** Definition of Remote Sensing – Electromagnetic spectrum and its divisions – Ideal remote sensing system – Outline of energy interaction with Earth's atmosphere and surface features – Types of aerial photographs – Photoscale and causes for its variations – Flight planning procedures – Stereoscopy, lens and pocket stereoscopes – Elements of photo interpretation – Aerial photo interpretation for geological applications

**UNIT II** Satellite remote sensing - Types of satellites – Outline of scanning systems – Sensor resolution: spectral, spatial, radiometric and temporal – Satellite data products – Sensor characteristics of Landsat, SPOT, IRS series and other high resolution satellites – Image interpretation elements and keys – Satellite image interpretation for geological studies -Overview of Indian Space Programme.

**UNIT III** Geographical Information System: Definition – history – Spatial and attribute data Important GIS softwares and their producers – GIS operations – Outline of spatial data input, attribute data management, data display, data exploration, data analysis and GIS modeling operations – Advantages and applications of GIS - Global positioning system

**UNIT IV:** Role of geology in mining industries – definition of mining terms, shaft, Hanging wall, Adit, roof, Drive crosscut, Tunnel, Raise, Winze, Stope – Types; Surface methods of mining, Alluvial mining – pan & betea, sluicing, Hydraulicking, Dredging. opencast mining. Benches, Explosives, working slope , mining equipments – Dragline, power showels.

**UNIT V:** Subsurface mining :- (underground mining )- advantages and limitations. Stoping – open stopes, supported stopes, pillar supported stopes – square supported stoping – timber supported stopes- filled stopes – shrinkage stopes – shaft sinking. Caving; Top slicing. Sublevel caving and Block caving.

Coal mining (surface mining) Strip mining and Augering.

Underground mining. Room and pillar method – Longwall method- hydraulicking. Mineral Economics and its concept. Role of Minerals in National Economy. Problems peculiar to Mineral Industruy, strategic, critical and Essential Minerals. Mineral conservation and substitution.

**TEXT BOOKS:**


1. Lillesand, T.M and R.W. Kiefer (2000). Remote sensing and image interpretation. John Wiley & Sons, New York
2. Sabins, F.F (1987). Remote sensing principles and interpretation. Freeman Publishers, New York
3. Miller, V.C (1961). Photogeology. McGraw-Hill Publishers, New York
4. Allum, J.A.E (1978). Photogeology and regional mapping, Pergamon Press Ltd., Oxford
5. Siegal, B.S and R. Gillespie (1980). Remote sensing in Geology, John Wiley & Sons, New York
6. Pandey, S.N (1987). Principles and applications of photogeology. Wiley Eastern Ltd., New Delhi
7. Burrough, P.A.(1986)- Principles of Geographical information system for land resource assessment.
8. Arogyaswamy, R.N.P. Courses in Mining Geology – Oxford &IBH, New Delhi.
9. Thamus, P.J. 1979 An introduction to mining, Methun.
10. Mc Kinstry, H.E 1960 Mining Geology, New york.


**REFERENCE BOOKS:**


1. Anji Reddy, M (2001). Textbook of remote sensing and GIS, BSP PS Publications, New Delhi
2. Rampal, K.K (1999). Handbook of aerial photography and interpretation. Concept Publishers Company, New Delhi
3. Narayan, L.R.A (1999). Remote sensing and its application. Universities Press Ltd., Hyderabad.


*******

**III Semester - Non – Major Elective – I**

**FUNDAMENTALS OF GEOLOGY**

**UNIT I:** Definition of Geology –– Branches of Geology – Geology in the service of Man. The Solar system: – The Planets – Meteorites – Asteroids – Satellites – Comets; Evolution of the Solar system –Nebular hypothesis – Planetesimal hypothesis – Structure and composition of Earth's interior.

**UNIT II:** Earthquakes: Definition – causes and effects – Focus and Epicenter – Magnitude and Intensity –Prediction of Earthquakes – Tsunami - Earthquakes in India. Volcanoes: Definition - Types –Causes of volcanism – Effects of Volcanic activity - Prediction of volcanoes.

**UNIT III:** Mass movements – Definition – Classification –Causes and remedial measures. Concept of plate tectonics – Different kinds of plate margins – Evidences in favor and against the concepts of Continental Drift and Plate Tectonics.

**UNIT IV:** Weathering of Rocks –weathering processes, chemical and mechanical weathering- Economic importance of weathering. Atmosphere – Its composition and zones. Wind – Geological actions of wind- sand dunes and their types.

**UNIT V**: Running water –erosion, transportation and deposition – brief study of land forms resulting from erosion and deposition. Underground water – sources – water table – zones of groundwater – springs and wells – artesian wells – geysers– aquifer. Glaciers – origin and types of glaciers. Seas and Oceans – waves, tides and currents– sea as a geological agent.

**TEXT BOOKS**


1. Arthur Holmes — Principles of physical Geology: Thomas Nelson & sons London.
2. Philip G. Worcester — A textbook of geomorphology: D. Van Nostrand co., London.
3. Radhakrishanan. V . — General Geology - V.V.P. Press.
4. Mahapatra, G.B. — A text book of Geology, CBS, Delhi


**REFERENCE BOOKS:**


1. William J. Miller — Principles of physical Geology : Thomas Nelson & sons , London.
2. W. D. Thornbury — A text book of geomorphology : D. Van Nostrand co., London.
3. A.L. Bloom — General Geology V.V.P. Press.
4. L.D. Leet & Judson — Physical Geology : Prentice Hall, India.


*******

**IV Semester - Non – Major Elective – I**

## MINERALS, ROCKS AND FOSSILS

**Unit I:** Definitions of Mineral, Mineraloid, Ore and Gangue. Brief study of Physical Properties of Minerals; Nature, Streak, Cleavage, Hardness, Luster and fracture Description of physical properties and chemical composition (a) Quartz group (Rock crystal, Amethyst, Chert, Chalcedony, Opal) (b) Feldspars (Orthoclase, Labradorite) (c) Pyroxenes (Hypersthene, Augite) and (d) Amphiboles (Anthophyllite, Hornblende). Study of physical properties and distribution of gemstones in Tamilnadu – Ruby, Sapphire, Emerald, Moonstone and Iolite.

**Unit II:** Physical properties, Chemical composition, origin and uses of; Iron ores (Magnetite, Hematite), Placers (Ilmenite, Garnet), Copper ores (Chalcopyrite, Malachite). Molybdenite, Calcite, Graphite, Asbestos, Talc, Celestite and Bauxite. Introductory knowledge about properties, origin and uses of Lignite of Neyveli: Origin and occurrence of Petroleum in Cauvery basin. Role of minerals in the production of Cement: Mineral wealth of Tamilnadu.

**Unit III:** Brief study of common characters of igneous rocks. Igneous structures - Dyke, Sill and Batholith. Tyrrell's tabular classification of igneous rocks:
Descriptive study of structure, texture, mineralogy and origin of; 1. Granite 2. Syenite 3. Gabbro 4. Dunite 5. Basalt 6. Pegmatite 7. Anorthosite and 8. Dolerite. Role of rocks in Granite industries

**Unit IV:** Common properties of sedimentary rocks. Simple classification of sedimentary rocks – Mechanical, Chemical, Organical and Residual. Description of texture, mineralogy and origin of (a) sandstone (b) conglomerate (c) Breccia (d) Shell-Limestone (e) Shale. General characters of metamorphic rocks. Agents and kinds of metamorphism. Brief study of slate, schist, gneiss, marble and charnockites.

**UNIT V:** Definition of Palaeontology — Classification of animals – Habitates and Habits of animals. Definition of fossils – Types of preservation of fossils. Uses of fossils. Megascopic identification and description of the following fossils:-
Corals: Calceola, zapherenits; Brachiopoda: Spriifer, Productus, Terebratula; Pelecypoda: Arca, Cardium. Meretrix, Cardita, Pectan; Gasteropoda: Natica, Turbo, Trochus, Turritella, Physa; Cephalopoda: Nautilus, Goniatites, Ceratites.

**TEXT BOOKS:**


1. Dana, F.S. 1955 - A text book of mineralogy – Asia publishing House, Wiley.
2. Tyrrel, G.W. 1978 - The principles of petrology – Chapman and Hall Ltd., London.
3. Mahapatra, G.B. - A text book of Geology, CBS, Delhi
4. Lindgren W. - Mineral Deposits, MCGraw Hill, 1933.


*******